



Facilities Development Manual

ORIGINATOR		PROCEDURE
Director, Bureau of Highway Development		13-30-5
CHAPTER	13	Drainage
SECTION	30	Channels and Road Ditches
SUBJECT	5	Channels Characteristics

Channels and road ditches are designed for the following channel characteristics: vertical alignment, horizontal alignment, roughness factors, and channel shape. A general discussion of these channel characteristics is given in this procedure while more specific channel design criteria are covered by [Procedure 13-30-10](#).

Vertical Alignment

The vertical alignment of a new channel should be similar to the profile of the existing channel. Abrupt changes in grade should be avoided in the new channel. If abrupt changes in grade are designed into the channel, one of the following two effects will occur:

1. Deposition of transported material will occur where the grade changes from steep to flat.
2. Scouring will occur when the grade changes from flat to steep.

Due to topographic features, it is normally impossible to design a channel without areas where deposition of material and/or scouring will occur. Therefore, other means of preventing these conditions from occurring must be part of the final design. Scouring of an open channel may be reduced or prevented by using riprap or channel paving. In addition, in areas where vehicles are not likely to travel, vertical grade drops may be used to maintain flat ditch grades that are non-erodible.

Horizontal Alignment

The designer should construct meandering channels to reproduce preconstruction conditions, to imitate nature, and to avoid steepening of gradients. Any change in alignment should be gradual, to minimize erosion. When it is necessary to construct curves that are not erosion resistant, the erosion may be controlled by using riprap and/or channel paving.

Roughness Factors

The capacity of a drainage channel depends upon its shape, size, slope, and roughness. A specific channel's capacity will decrease as the roughness factor increases. This factor may be used to decrease the erosion potential of a channel on a steep grade by decreasing the flow velocity by increasing the channel's roughness. Conversely, a specific channel's capacity will increase as the channel's roughness decreases. Therefore, the capacity of channels with flat slopes may be increased by constructing smooth channel walls that will maintain a higher velocity.

A table of roughness coefficients (n) for Manning's Equation can be found in [Procedure 13-25-35](#). With the use of this table and engineering judgment, the approximate

roughness coefficients of existing channels should be determined through a field review. Any erosion or deposition of material in the existing channel(s) should be noted and recorded. These facts can be used in the design stage to compare the compatibility of new channels with the existing channels.

Channel Shape

Channels are usually constructed with a parabolic, trapezoidal, or triangular shape. Ideally, all channels should be parabolic in shape because of their increased capacity and stability. On the other hand, trapezoidal channels, used for WisDOT channel changes, are easy to construct and exhibit a large carrying capacity, but they tend to silt in because of wide, flat bottoms. Triangular shaped channels, used for WisDOT roadway side ditches because of construction equipment practicalities, tend to scour easily in the "V" of the channel because of high velocities at that point. Fortunately, over the years triangular and trapezoidal sections tend to naturally become parabolic in shape because of siltation and bank erosion. ★